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Sloping local base level: a tool to estimate potential erodible volume and infilling alluvial sediment of glacial valleys

Jaboyedoff Michel (1), Bardou Eric (1), Derron Marc-Henri (2)

(1) Quanterra, Lausanne, Switzerland, michel.jaboyedoff@quanterra.org
(2) Geological Survey of Norway, Trondheim, Norway

The concept of Sloping Local Base Level (SLBL) is a generalisation of the base level defined in geomorphology, applied to landslides. It permits to define a surface above which rocks are assumed being erodible. The SLBL can be determined either manually, or by using an iterative routine. Considering a spur along an infinite slope in a 2D-approach, the SLBL corresponds to a line joining the top and the bottom of the spur. Assuming equidistant z_i altitude raw data, the SLBL is found by an iterative procedure. All points located above the mean of their two neighbours are replaced by their mean value or by their mean value ± a tolerance D (Jaboyedoff et al., 2004). In 3D, the procedure is similar. The test is simply made by using the highest and the lowest value among the four direct neighbours. This method can be applied either to rock slopes or to soil slopes.

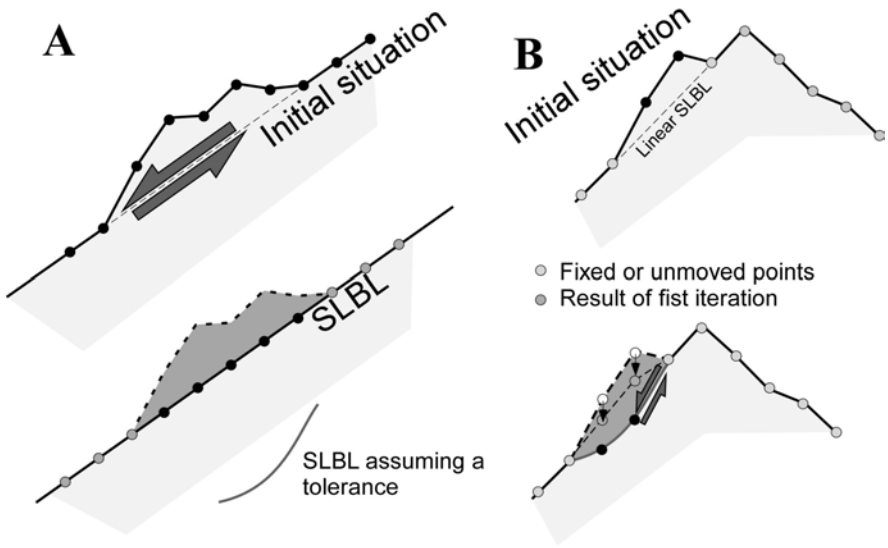

Figure 1: (A) Illustration of the linear SLBL for a spur. (B) Curved SLBL assuming a tolerance leading to rotational-like surface.

For computation purposes, some points of the SLBL must be fixed; otherwise the result is a flat topography. The SLBL can be computed by defining the limits within which the SLBL must be estimated, i.e. an unstable rock mass or a landslide. The limits are defined using geomorphic features. The base of the zone is either the bottom of the valley or a slope angle break. The top is estimated using the cracks or any trace of fault. The lateral limits are defined by the extent of the geomorphic feature.

Part of the sediment transport in the Alps is provided by landslides. Many

observations indicate that many most slopes are slowly moving down (~0.1mm). The SLBL permits to define the volumes slowly moving down. This contribution to erosion must be integrated in global erosion model.

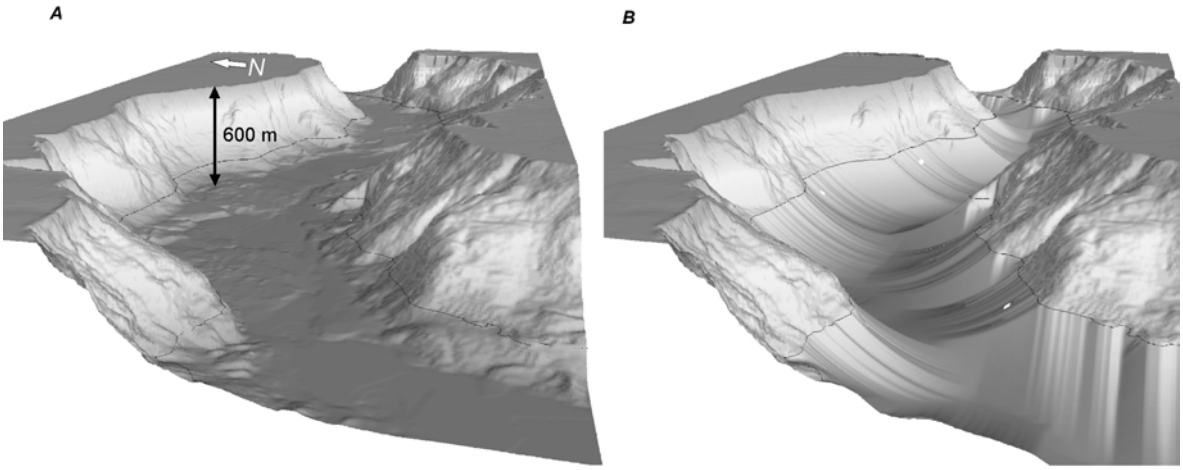

Figure 2: Results for the bedrock of the valley of Romsdal in Norway, using the SLBL. (A) Present state, (B) Expect bottom of valley.

Erosion analysis must also integrate the sediment stocks. The SLBL allows also to estimate the volumes of sediments filling the glacial valleys. Preliminary results on the Rhône Valley are in a good agreement with seismic data and gravity data.

References

Jaboyedoff, M., Baillifard, F., Couture, R., Locat, J., and Locat, P. 2004: Toward preliminary hazard assessment using DEM topographic analysis and simple mechanic modeling. Lacerda, W.A., Ehrlich. M. Fontoura, A.B. and Sayo. A (eds): Landslides Evaluation and stabilization. Balkema, 191-197.